

## CLAIMS

1. A space cross-connect unit (Z) with N input ports ( $E_i$ ) and P output ports ( $S_i$ ), comprising:
  - a broadcast stage comprising at most N signal dividers ( $A_i$ ) each having one input and C outputs where C is an integer factor of P less than P, each input being connected to one of said N input ports ( $E_i$ ) so that each of said N dividers ( $A_i$ ) divides a signal received at one of said N input ports ( $E_i$ ) into C signals at said C outputs, and
  - a space switching stage comprising at most C space switching modules ( $B_i, B'_i$ ),which cross-connect unit is characterized in that:
  - the C space switching modules ( $B_i, B'_i$ ) are non-blocking and non-broadcasting, and
  - each of said C modules ( $B_i, B'_i$ ) has N inputs and P/C outputs, said N inputs are connected to N outputs of said broadcast stage, each of said N outputs comes from a different divider ( $A_i$ ), and each of said P/C outputs of said C modules ( $B_i, B'_i$ ) is connected to a respective one of said P output ports ( $S_i$ ).
2. A cross-connect unit (Z) according to claim 1, comprising exactly N dividers ( $A_i$ ) and C modules ( $B_i, B'_i$ ).
3. A cross-connect unit (Z) according to claim 1, characterized in that each of said C modules ( $B_i, B'_i$ ) comprises means for connecting each of its N inputs to one of its P/C outputs.
4. A cross-connect unit (Z) according to claim 1, characterized in that each of said C switching modules ( $B_i, B'_i$ ) is a non-blocking switching matrix ( $B_i$ ) with N inputs and P/C outputs.
5. A cross-connect unit (Z) according to claim 1,

characterized in that each of said C switching modules ( $B'_i$ ) comprises:

- K non-blocking switching matrices ( $F_i$ ) with  $N/K$  inputs and  $P/C$  outputs, where K is an integer factor of N; and
- 5 ·  $P/C$  non-blocking switching matrices ( $G_i$ ) with K inputs and one output, each of said K inputs being connected to a respective output of each of said K switches ( $F_i$ ).

6. A cross-connect unit (Z) according to claim 1,  
10 characterized in that at least one of said C switching modules ( $B'_i$ ) comprises:

- K non-blocking switching matrices ( $F_i$ ) with  $N/K$  inputs and  $P/C$  outputs, where K is an integer factor of N; and
- $P/C$  non-blocking switching matrices ( $G_i$ ) with K inputs
- 15 and one output, each of said K inputs being connected to a respective output of each of said K switches ( $F_i$ ).

7. A cross-connect unit (Z) according to claim 1,  
characterized in that said  $P/C$  switching matrices ( $G_i$ ) are  
20 semiconductor optical amplifier (SOA) switches.

8. A cross-connect unit (Z) according to claim 1,  
characterized in that said number N of input ports is  
equal to said number P of output ports.

25 9. A cross-connect unit (Z) according to claim 5,  
characterized in that K is equal to C.

10. A cross-connect unit (Z) according to claim 1,  
30 characterized in that said switching stage uses a technology based on  $\text{LiNbO}_3$ .

11. A cross-connect unit (Z) according to claim 1,  
characterized in that each of said  $P/C$  outputs of said C  
35 modules ( $B_i$ ,  $B'_i$ ) is followed by an amplifier ( $D_s$ ).

12. A cross-connect unit according to claim 1,

characterized in that each of said N inputs of said N dividers is preceded by an amplifier ( $D_E$ ).

13. A cross-connect unit (Z) according to claim 1,  
5 characterized in that each of said space switching modules ( $B_i$ ,  $B'_i$ ) comprises:
- a first stage comprising polarization-maintaining space switching matrices ( $M_1$ , ...,  $M_k$ ); and
  - a second stage comprising polarization-maintaining  
10 semiconductor optical amplifiers ( $MQWSOPA_1$ , ...,  $MQWSOA_k$ ).

14. A signal transmission system comprising a cross-connect unit (Z) according to any one of claims 1 to 13 and characterized in that said system comprises:
- 15 · at least one multiplexer for multiplexing M signals having M different wavelengths  $(\lambda_i)_{1 \leq i \leq M}$ , where M is an integer less than or equal to N;
- at least one erbium-doped fiber amplifier (EDFA) for amplifying the multiplexed signal; and
- 20 · at least one demultiplexer for demultiplexing the multiplexed signal to yield M demultiplexed signal that are input to M input ports of said cross-connect unit.